

HOW I DO IT

Reconstruction After Larynx-Preserving Extensive Tracheal Resection With Axillofemoral Bypass Grafting and Free Skin Flap Implantation

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INTRODUCTION

End-to-end anastomosis of the tracheal stumps is an established reconstruction procedure after resection of the mediastinal trachea. However, the length of the resectable tracheal segment is limited. It is particularly short in patients who have previously undergone an upper-mediastinal operation, because mobilization of the trachea is restricted by peritracheal adhesions. In such cases, speaking function is usually sacrificed and total laryngectomy with mediastinal tracheostomy is performed. However, extremely deep mediastinal tracheostomy is required when the distance between the tracheostoma and the tracheal bifurcation is short. The risk involved in this procedure is high because the brachiocephalic artery and aortic arch obstruct the tracheostoma.

OPERATIVE TECHNIQUE

We describe the operative technique in which a long segment of the mediastinal trachea was successfully resected without laryngectomy in a patient who developed a recurrent peritracheal lesion after subtotal esophagectomy for cancer of the proximal esophagus. Esophagectomy was performed through a median sternotomy and right thoracotomy. The involved membranous portion of the trachea was resected and covered with a pedunculated intercostal muscle flap (Fig. 1A,B). A stomach roll was brought up through the posterior mediastinum to the neck and anastomosed with the esophagus immediately below the cricopharyngeal sphincter in an end-to-side fashion. All macroscopically recognizable lesions were resected intraoperatively. Chemotherapy with cisplatin and 5-fluorouracil was administered postoperatively.

A recurrent peritracheal tumor 50 mm in longitudinal diameter was detected on computed tomography (CT) 12 months after esophagectomy (Fig. 1C). The lesion showed invasion of the stomach roll and trachea. No other systemic metastatic lesions were detected on CT, echography, bone scintigraphy, or physical examinations. The tumor had not been visible on CT scans obtained 6 months previously. The rapid tumor growth suggested that the patient would develop fatal tracheal obstruction or a tracheogastric fistula in a short time. Since radiochemotherapy had already been provided, we operated on the patient 1 month after detection of the recurrence.

A bypass graft was interposed between the right axillar artery and the external iliac artery. The right upper quarter of the sternum, the median half of the right clavicle, and the right first and second costal cartilages were removed. The right brachiocephalic vein and the brachiocephalic artery were divided with linear staplers. The tumor was resected together with segments of the trachea and stomach roll (Fig. 2). The trachea was divided at the level of the upper end of the sternum and at the portion 1.5 cm proximal to the bifurcation. The resected tracheal segment was 6 cm in length. The cervical portion of the stomach roll was preserved in continuity with the remnant esophagus, although the continuity of the perigastric vascular arcades was interrupted. Special care was taken to avoid dissociating the adhesions around the cervical

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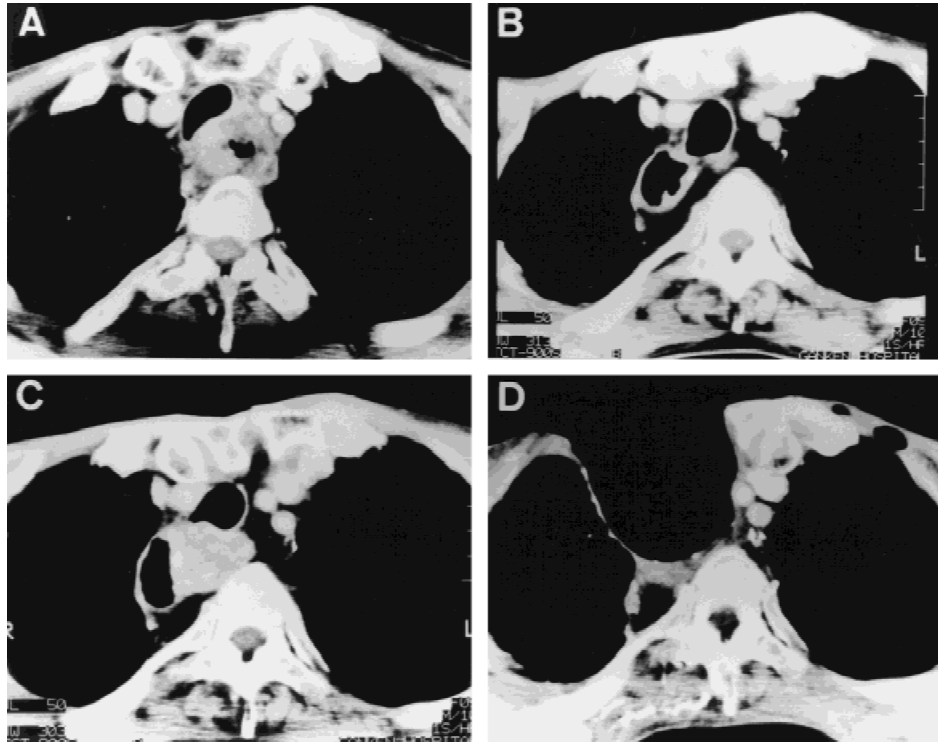


Fig. 1. Computed tomograms. (A) Esophageal cancer before treatment. Tracheal invasion was strongly suspected and preoperative radiochemotherapy was performed. (B) Five months after esophagectomy. A stomach roll was brought up through the retromediastinum and the esophageal bed was filled with the omentum. The mass behind the membranous portion of the trachea is the intercostal muscle flap with which the defect of the tracheal resection was repaired. (C) Eleven months after esophagectomy. The recurrent tumor invaded the trachea and the stomach roll. (D) Six months after wide resection of the recurrent tumor. The air spaces in the left anterior chest wall are the ileum used for bowel reconstruction.

remnant stomach, so as to preserve the vascular connection that had developed after the previous operation. A temporary gastrocutaneostoma was made in the neck. A large free forearm skin flap with vessels was prepared and the anterior mediastinal defect was covered with this flap (Fig. 1D). This procedure formed a wide deep hollow on the anterior chest wall. Two tracheostomata were made between the skin flap and tracheal stumps. The vascular pedicles of the free skin flap were anastomosed to the internal thoracic vessels. Bowel continuity was reestablished 40 days later with a ileocolon brought up through a subcutaneous tunnel and interposed between the cervical remnant stomach and the jejunum. The ileocolic vessels were anastomosed with the left thoracoacromial artery and cephalic vein to prevent necrosis of the tip of the substitute. The gastrostoma was subsequently closed.

The postoperative course was uneventful. A specially designed T-shaped tube was made for speaking which was applied between the proximal and distal tracheostomata in the hollow on the anterior thoracic wall, and it worked well. The patient remained alive and well without any detectable cancer lesions 1 year and 3 months after resection of the mediastinal recurrent lesion.

DISCUSSION

Extensive resection of the mediastinal trachea is a high-risk procedure, because the reconstruction must be made deep in the mediastinum. Suture insufficiency frequently leads to rupture of the great vessels. The brachiocephalic artery is the vessel most commonly injured after mediastinal tracheostomy [1,2]. Special care should be given to maintaining blood circulation in the tracheal stump, assuring appropriate tension at the anastomosis, and preventing infection.

Division of the brachiocephalic artery was found to be useful for obtaining a good operative view allowing resection of the recurrent tumor and deep tracheocutaneous anastomosis, for avoiding postoperative arterial erosion [2], and for providing a wide space between the proximal and distal tracheostomata. To prevent possible brain damage caused by decreased blood pressure in the right carotid and vertebral arteries, bypass grafting is recommended. We initially established an axillofemoral bypass without difficulty.

In mediastinal tracheostomy, a pedunculated skin flap, such as a latissimus dorsi musculocutaneous flap, major pectoral musculocutaneous flap, or deltoidpectoral cutaneous flap, has commonly been used to decrease anas-

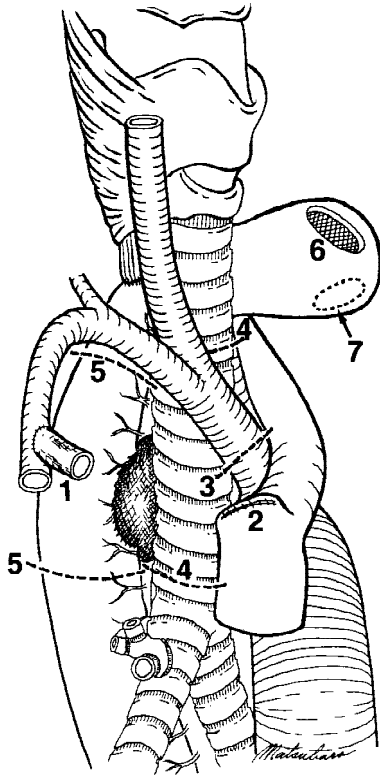


Fig. 2. The operative procedure. After axillofemoral bypass grafting (1), the right brachiocephalic vein (2) and brachiocephalic artery (3) were divided. The trachea (4) and stomach roll (5) were resected. Temporary gastrostomy was performed in the neck (6). Later, the ileocolon was brought up to the neck and anastomosed to the remnant stomach (7).

tomotic tension and fill the dead space between the tracheal stump and the large vessels [1]. We used a free forearm skin flap in the present case, because it is thinner and, therefore, more flexible than other types. A thin free flap is optimal for obtaining an operative view sufficient for deep tracheocutaneous suturing [3]. The forearm flap is also excellent for covering a large open mediastinal cavity with a complex shape between the proximal and distal tracheostomata, preserving a space of adequate width to hold a T-shaped tube for speaking.

The T-shaped tube should be carefully designed so as

to preserve good speaking function. Special care was devoted to maintaining adequate contact pressure between the tube and the orifices of the tracheostomata so as to prevent air leakage while avoiding erosion of the tracheal stumps. We designed the tube based on a frontal CT image of the remnant tracheal segments. The portions in contact with the tracheostomata were tapered.

In the present case, the tumor also invaded the stomach roll. Since esophagogastric anastomosis had been done immediately below the cricopharyngeal sphincter at esophagectomy, we resected only the involved segment of the stomach roll and preserved the rest portion in an effort to decrease the operative risk. Bowel reconstruction was performed 40 days later. Though the gastroepiploic vessel arcades were resected, the cervical remnant stomach had sufficient blood circulation through vessels that had developed in adhesions with the cervical muscles.

Tumor recurrence limited to the peritracheal region is not rare after curative operation for cancer of the thoracic esophagus [4]. Most patients die in a short time due to local complications such as airway obstruction or fistulae between the trachea and the neighboring large vessels or stomach roll. The benefit of surgical resection of the recurrent lesions after esophagectomy is not generally accepted. We previously reported that, in our series of 13 patients who underwent operative resection of recurrent lesions, the 1-year survival rate after recurrence was 83% with a median survival period of 592 days [4]. We consider surgical removal of the recurrent lesions to be a good palliative procedure for cases in which these lesions are macroscopically localized and technically resectable.

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